CHAPTER V
CONCLUSIONS

In this study, the technology and economics of hydrogenated biodiesel are compared to conventional biodiesel production, using ICAS and PRO/II® programs. The results indicate that with palm oil as feedstock and the capacity of 200,000 ton product/year, the capital cost and the manufacturing cost of the hydrogenated biodiesel and SMR-hydrogenated biodiesel processes are higher than the conventional biodiesel process. Reactors and distillation columns are the major of the capital cost for biodiesel process while the compressors and hydrotreater are the main capital cost of hydrogenated biodiesel and SMR-hydrogenated biodiesel processes. In spite of hydrogenated biodiesel process having smaller number of unit operations; hydrogenated biodiesel process has higher total capital investment. This is due to the fact that hydrogenated biodiesel process requires gas compressors which are expensive. Moreover, the material of hydrotreating reactor has to be hestelloy to be able to stand high pressure, high temperature and corrosion.

Direct manufacturing expenses were calculated based on the price and consumption of each chemical and utility. The direct manufacturing cost represents 98.8, 98.8 and 99.6 % of the total manufacturing cost in hydrogenated biodiesel, SMR-hydrogenated biodiesel and biodiesel processes, respectively. The largest proportion of the direct manufacturing cost is due to the palm oil feedstock, namely 91.8 %, 95.8% for hydrogenated biodiesel and SMR-hydrogenated biodiesel processes, and 82.2 % for biodiesel processes. Biodiesel process has the lowest total manufacturing cost. Adding SMR to hydrogenated biodiesel process could reduce the manufacturing cost of hydrogenated biodiesel. It was also found that in order to produce same amount of product, hydrogenated biodiesel requires higher amount of vegetable oil feedstock than biodiesel. Therefore, the production cost of biodiesel is lower than that of hydrogenated biodiesel. However, in terms of energy produced, the economics of hydrogenated biodiesel and biodiesel processes are comparable.

The overall manufacturing cost of hydrogenated biodiesel, SMR-hydrogenated biodiesel and biodiesel were analyzed as a function of feedstock price. The cost of palm oil feed is the largest component of the overall manufacturing cost.

Using the process models developed in this work, it was found that as the manufacturing cost of hydrogenated biodiesel strongly depends on crude palm oil price, the difference in the manufacturing cost between hydrogenated biodiesel and biodiesel becomes higher when crude palm oil price increases. This is due to palm oil feedstock cost forms the largest proportion of the manufacturing cost, namely 91.8 %, 95.8% for hydrogenated biodiesel and SMR-hydrogenated biodiesel processes, and 82.2 % for biodiesel process.

In addition, the large scale (100 ml catalyst) reactor has already been contructed and utilized for producing 30 litres hydrogenated biodiesel from crude jatropha oil for engine test.

For the future work, the simulations for economics evaluation of the biodiesel and hydrogenated biodiesel processes will be improved to be a user-friendly package. The causes of catalyst deactivation will also be studied. Moreover, the effect of catalyst metals and supports on the production of hydrogenated biodiesel and biojet will be studied.